Internal traveling waves, energy trapping, and energy release in time domain simulations of incident Gaussian-pulse scattering by single particles

R. Lee Panetta[*], Siyao Zhai, and Ping Yang

Department of Atmospheric Sciences, Texas A&M University, College Station, TX 77843, USA

[*]*Presenting author (panetta@tamu.edu)*

Time-domain simulations of single particle scattering involve cpu intensive near-field calculations. When the incident electromagnetic energy is in the form of a time-localized burst, the question of how long the simulations must be run becomes one of how long it takes for near-field amplitudes to decay to a negligible level. Examination of near-field decay of electromagnetic energy in pseudo-spectral time-domain simulations of Gaussian-pulse interactions with single particles shows presence of intermittent episodic bursts of amplitude. These bursts have been traced to the release of electromagnetic energy transiently trapped within the particles. The trapped energy is organized in the form of waves continually traveling within the particles. The waves have amplitudes that are generally maximal near but inside particle boundaries, and the observed near field episodic bursts appear to be results of either interactions between separate traveling maxima, or entrance of individual maxima into boundary regions of increased curvature. We present some examples of the interactions in the case of simple particle shapes and present a simple mathematical model in which factors determining the location of traveling wave amplitude maxima and the speed of propagation can be understood.

Preferred mode of presentation: Oral